1. Eingabedaten Wandscheibe aus Brettsperrholz

Nachweise nach DIN EN 1995, Deutschland, Nutzungsklasse 2

1.1. Berechnungseinstellungen

Netzdichtefaktor = 2 [-]

2. Systembeschreibung

Systemlänge l = 3000 mm, Systemhöhe h = 6000 mm

2.1. Wandtyp

Mestek (benutzerdefiniert), Aufbau **20.0**-20.0-**20.0**-20.0-**20.0** Nadelvollholz, C24 (S10)
Decklagen in x-Richtung, d = 100.0 mm ⇒ d_x = 60 mm, d_y = 40 mm,
Schmalflächen nicht verleimt

2.2. Statische Werte

Schubkorrekturfaktor κ_x = 0.231605, κ_y = 0.178945
Brettbreite b = 200 mm, Achsabstand der Bretter a = 200 mm
Nachweis nach Mestek mit I_p = 266666667 mm⁴

2.3. Festigkeiten

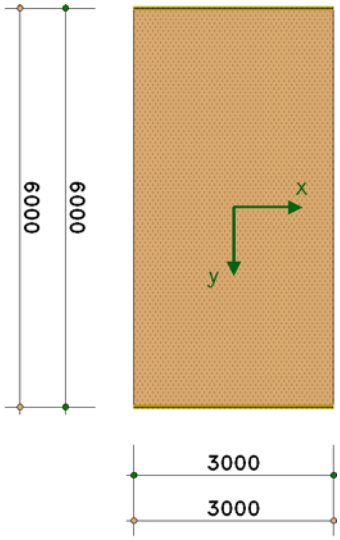
$f_{c0,k}$ = 21.00 N/mm², $f_{t0,k}$ = 14.50 N/mm², $f_{v,k}$ = 2.00 N/mm², $f_{tor,k}$ = 2.50 N/mm², $f_{vR,k}$ = 0.70 N/mm²□□

2.4. Linienlager

Name	x_a [mm]	y_a [mm]	x_e [mm]	y_e [mm]	Lager - x kN/mm²	Lager - y kN/mm²	Lager - mz kNm/m
Lagerlinie 1	-1500	-3000	1500	-3000	starr	100	10000
Lagerlinie 2	-1500	3000	1500	3000	starr	100	10000

2.5. Wandscheibe

Ansicht Maßstab 1:1139



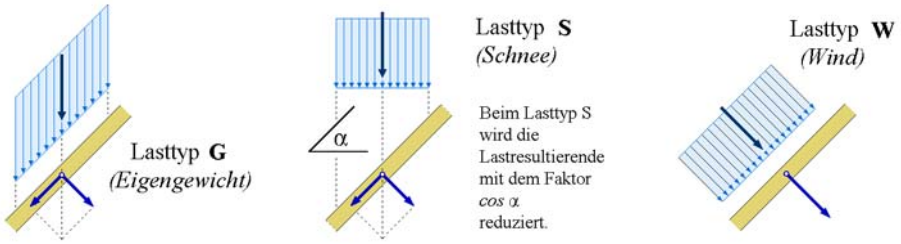
3. Einwirkungen / Lasten

Beschreibung der Belastungsstruktur

Auf der linken Seite sind die Beziehungen der Einwirkungen, Lastfallordner und Lastfälle zueinander in einer Baumstruktur dargestellt. Auf der rechten Seite sind die überlagerungsspezifischen Eigenschaften den links stehenden Objekten zugeordnet angegeben. Ein Lastfallordner entspricht überlagerungstechnisch einer Extremierung der in ihm definierten Objekte und kann seinerseits wiederum additiv oder alternativ überlagert werden.

verwendete Symbole: Einwirkung | Lastfallordner | Lastfall | Imperfektionsfälle

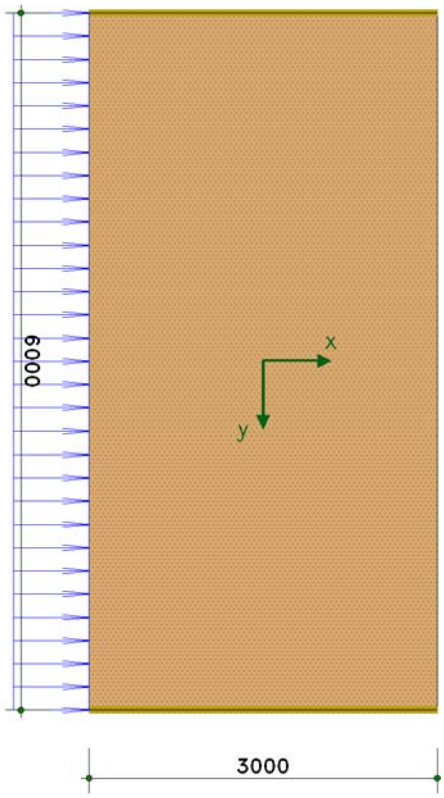
1: Windlasten	**veränderliche Windlasten**
1: Windlast (1)	alternativ in Gruppe A



1: Veränderliche Einwirkung: Windlasten
Windlast (1)

Name Linienlast	Typ [-]	x_a [mm]	y_a [mm]	x_e [mm]	y_e [mm]	$qx(l)_a$ [kN/m]	$qx(l)_e$ [kN/m]	$qy(m)_a$ [kN/m]	$qy(m)_e$ [kN/m]
Linienlast 1	W	-1500	3000	-1500	-3000	0.00	0.00	10.00	10.00

Alle Lasten Maßstab 1:652



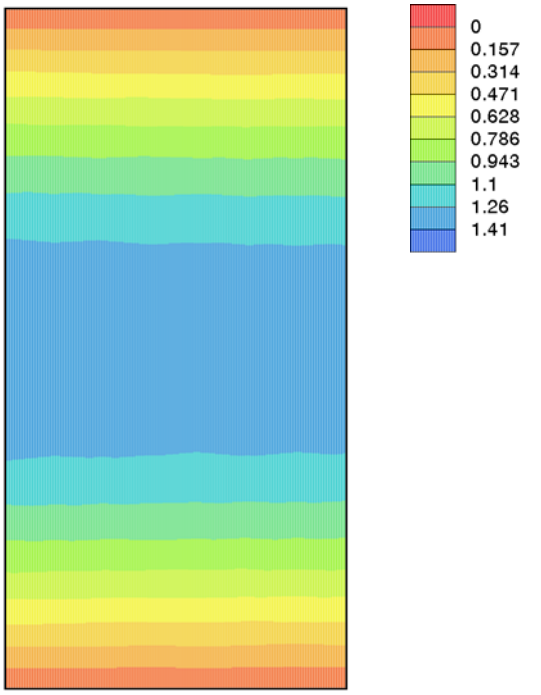
4. Lastfallergebnisse

4.1. Flächenergebnisse

4.1.1. 1 (Gruppe A): Windlast (1)

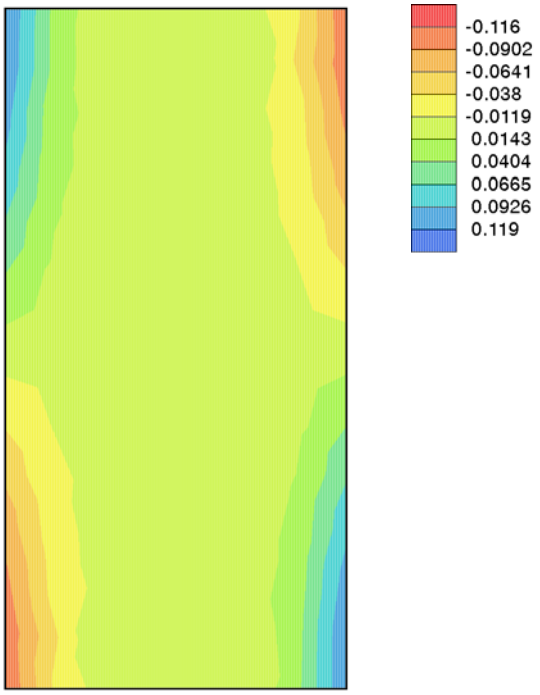
Verformungen u_x [mm]

min u_x = 0.0000 mm, max u_x = 1.4140 mm



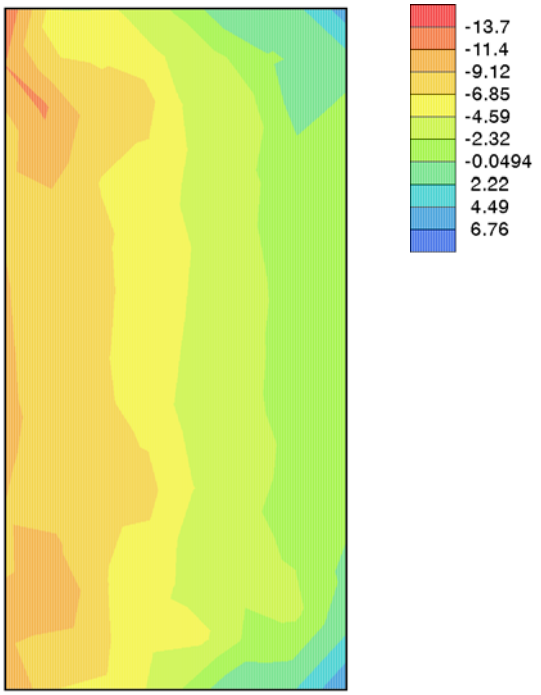
Verformungen u_y [mm]

min u_y = -0.1163 mm, max u_y = 0.1187 mm



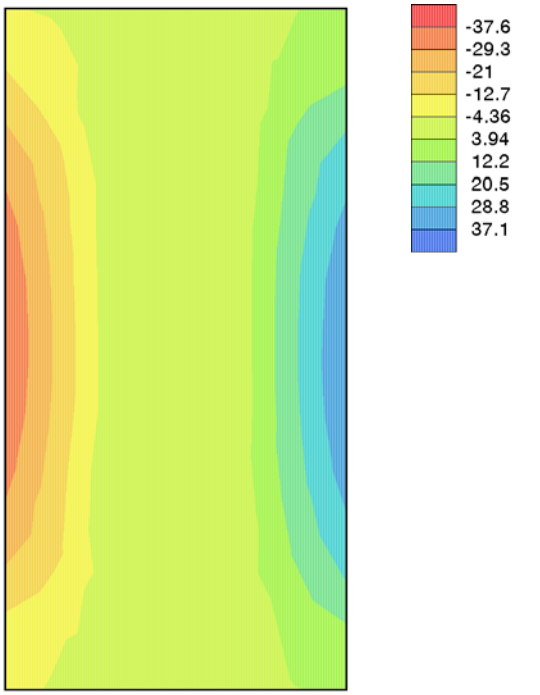
Normalkräfte n_{xx} [kN/m]

min n_{xx} = -13.66 kN/m, max n_{xx} = 6.76 kN/m

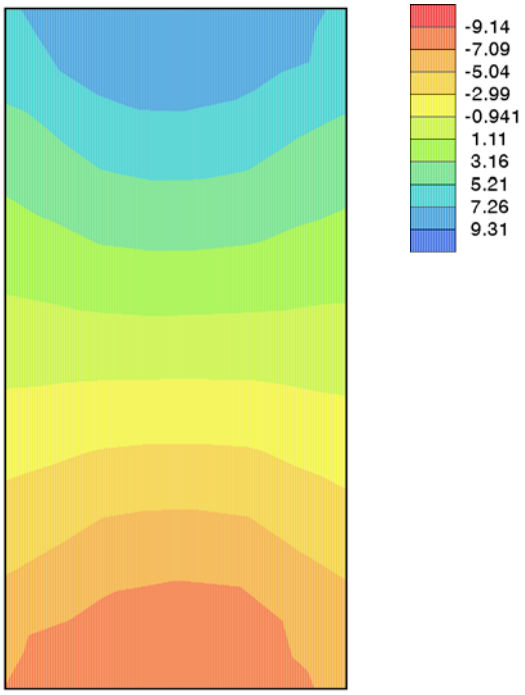


Normalkräfte n_{yy} [kN/m]

min n_{yy} = -37.57 kN/m, max n_{yy} = 37.15 kN/m



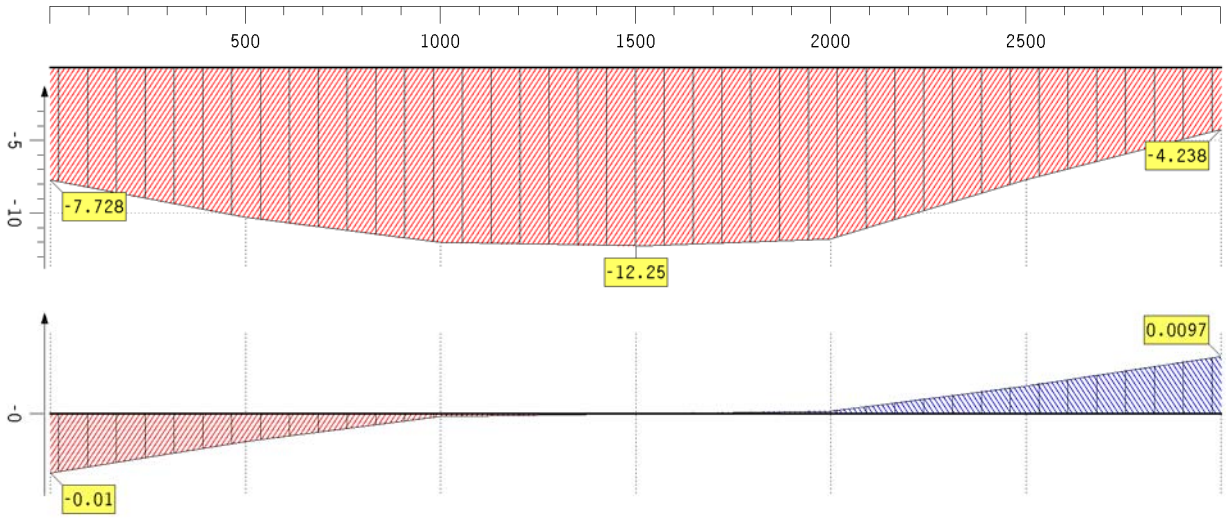
Normalkräfte n_{xy} [kN/m]
min n_{xy} = -9.14 kN/m, max n_{xy} = 9.31 kN/m



4.2. Linienlagerergebnisse

4.2.1. 1 (Gruppe A): Windlast (1)

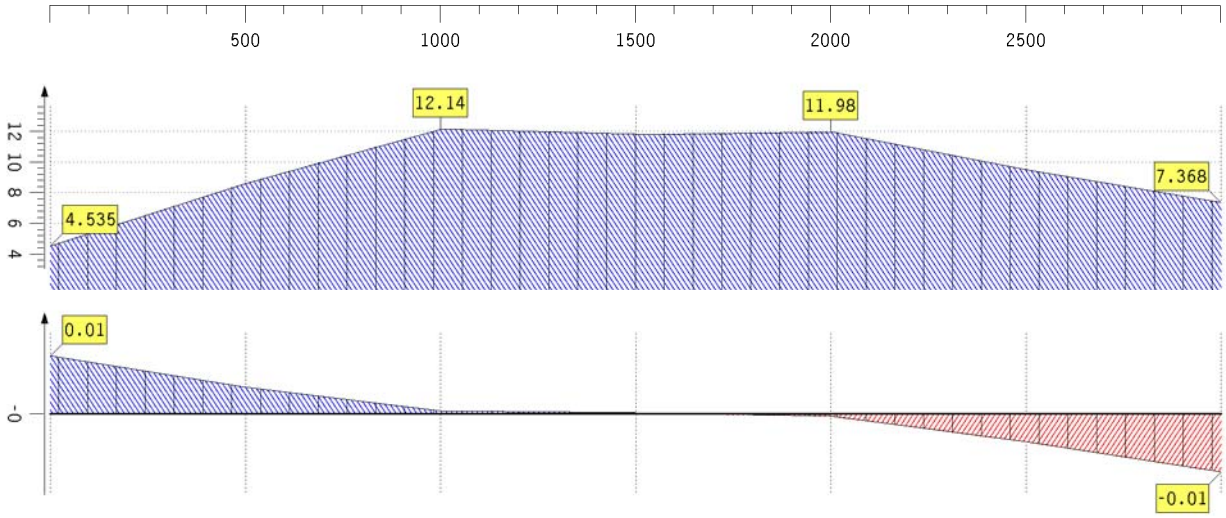
Auflagergrößen Lagerlinie 1



pl [kN/m]
min/max
12.248 / -4.238
Int = -30.000

pm [kN/m]
min/max
0.010 / 0.010
Int = -0.000

Auflagergrößen Lagerlinie 2



pl [kN/m]
min/max
.535 / 12.136
Int = 30.000

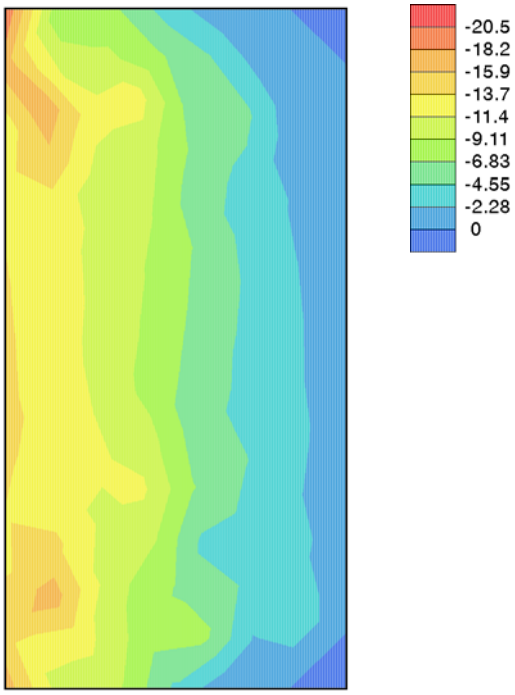
pm [kN/m]
min/max
0.010 / 0.010
Int = -0.000

5. Nachweisergebnisse

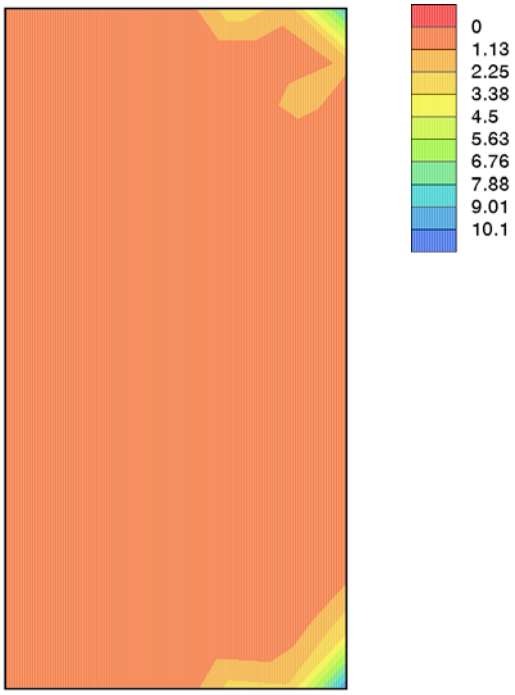
5.1. EC 5 Tragfähigkeit (Th.I.Ord.)

5.1.1. Zusammenfassung

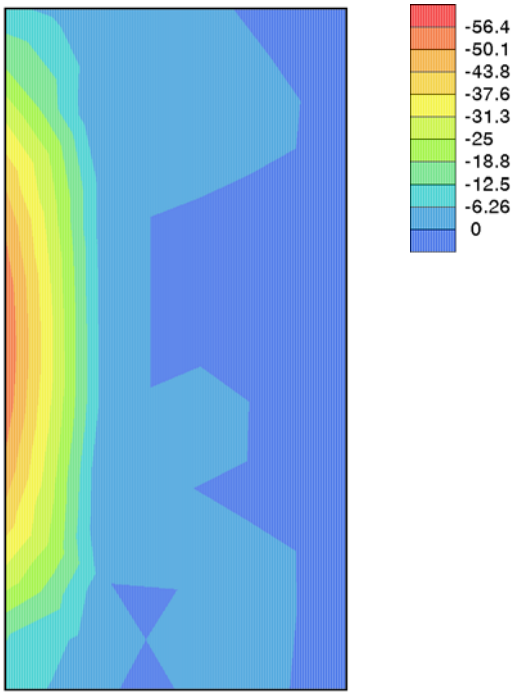
Normalkräfte min n_{xx} [kN/m]
min n_{xx} = -20.49 kN/m, max n_{xx} = 0.00 kN/m



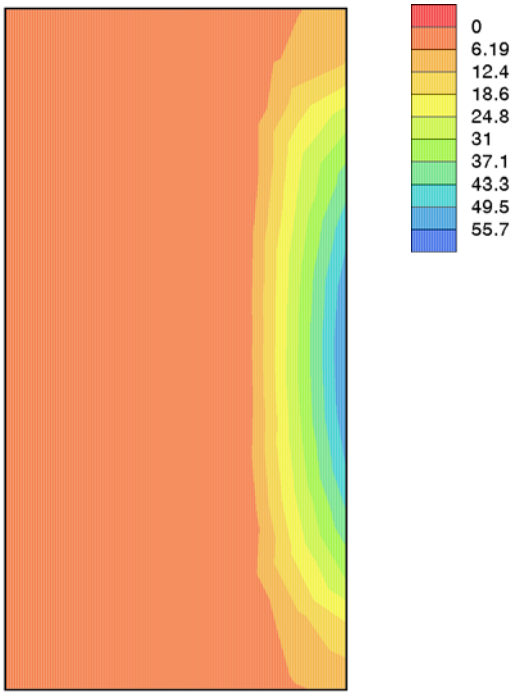
Normalkräfte max n_{xx} [kN/m]
min n_{xx} = 0.00 kN/m, max n_{xx} = 10.13 kN/m



Normalkräfte min n_{yy} [kN/m]
min n_{yy} = -56.35 kN/m, max n_{yy} = 0.00 kN/m

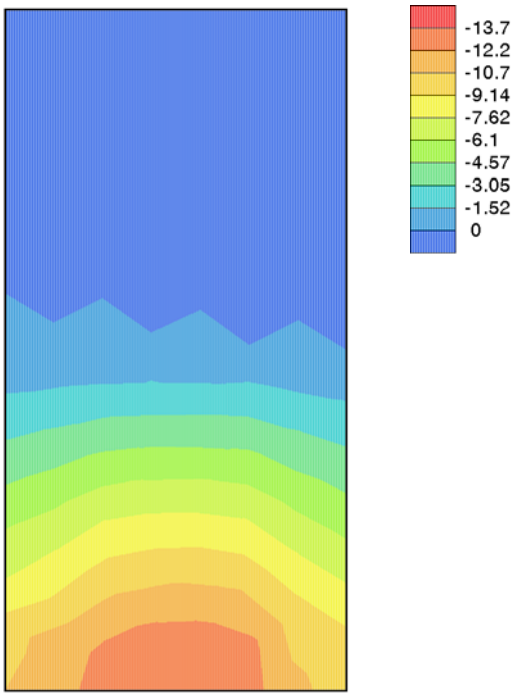


Normalkräfte max n_{yy} [kN/m]
min n_{yy} = 0.00 kN/m, max n_{yy} = 55.72 kN/m



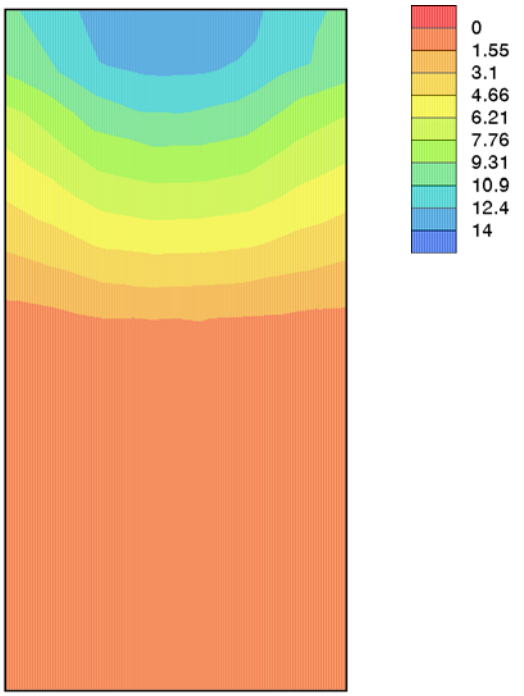
Normalkräfte min n_{xy} [kN/m]

min n_{xy} = -13.72 kN/m, max n_{xy} = 0.00 kN/m



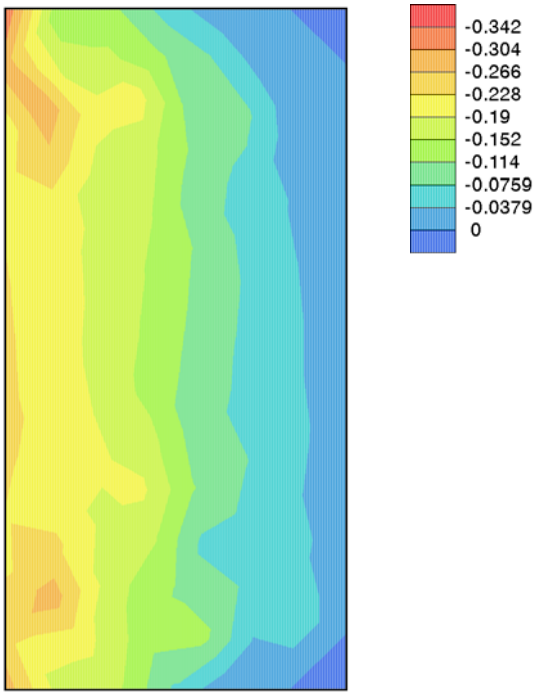
Normalkräfte max n_{xy} [kN/m]

min n_{xy} = 0.00 kN/m, max n_{xy} = 13.97 kN/m



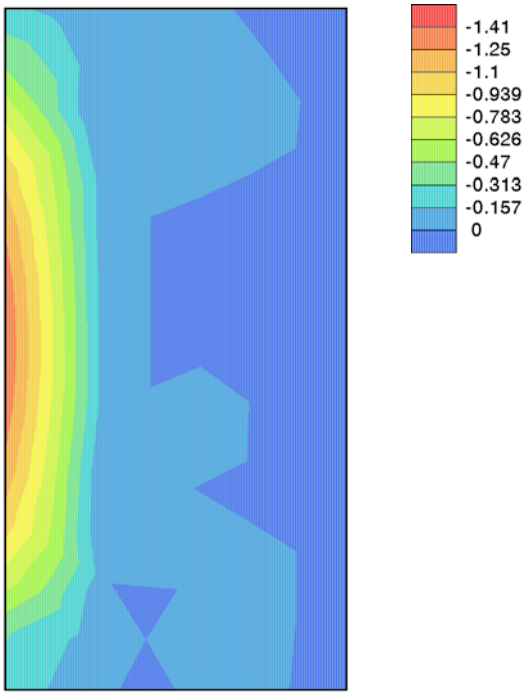
Normalspannungen $\sigma_{xx,min}$ [N/mm²]

min $\sigma_{xx,min}$ = -0.34 N/mm², max $\sigma_{xx,min}$ = 0.00 N/mm²



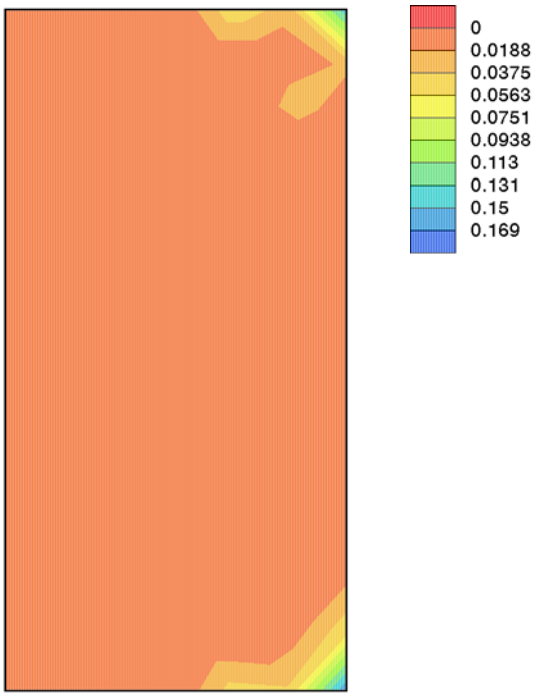
Normalspannungen $\sigma_{yy,min}$ [N/mm²]

min $\sigma_{yy,min}$ = -1.41 N/mm², max $\sigma_{yy,min}$ = 0.00 N/mm²



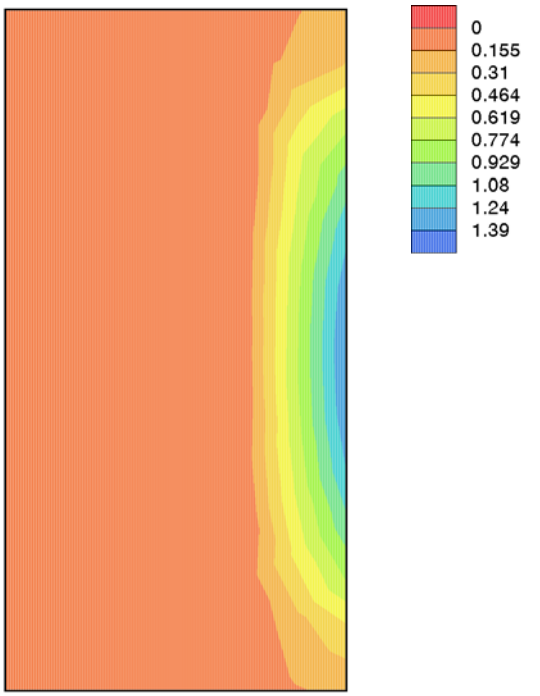
Normalspannungen $\sigma_{xx,max}$ [N/mm²]

min $\sigma_{xx,max}$ = 0.00 N/mm², max $\sigma_{xx,max}$ = 0.17 N/mm²



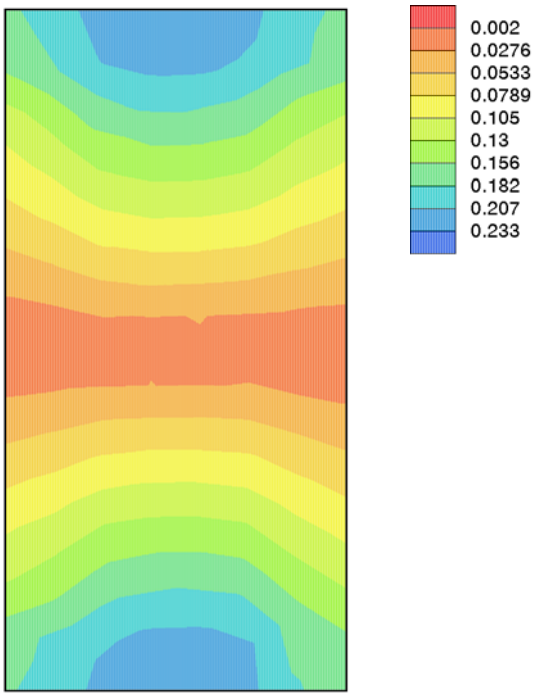
Normalspannungen $\sigma_{yy,min}$ [N/mm²]

min $\sigma_{yy,max}$ = 0.00 N/mm², max $\sigma_{yy,max}$ = 1.39 N/mm²



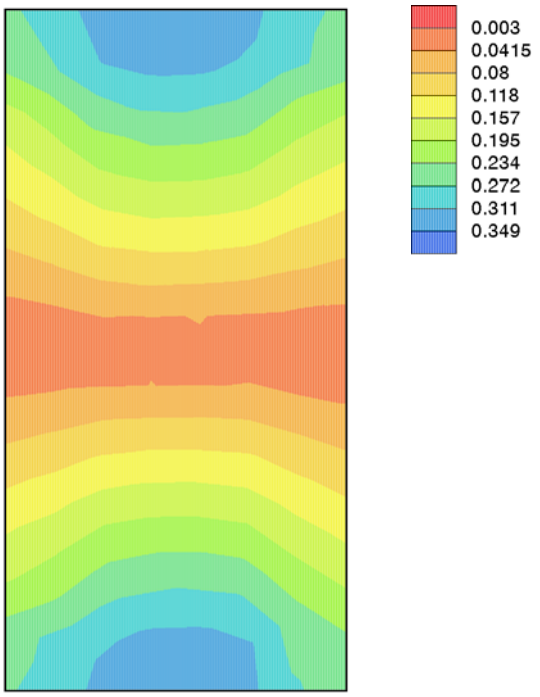
Schubspannungen τ_{xy} [N/mm²]

min τ\xy = 0.00 N/mm², max τ_{xy} = 0.23 N/mm²



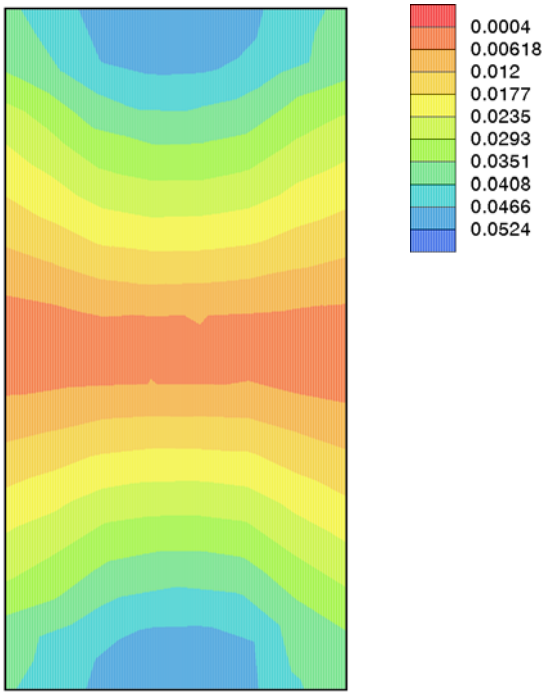
Schubspannungen τ_{yx} [N/mm²]

min τ_{yx} = 0.00 N/mm², max τ_{yx} = 0.35 N/mm²



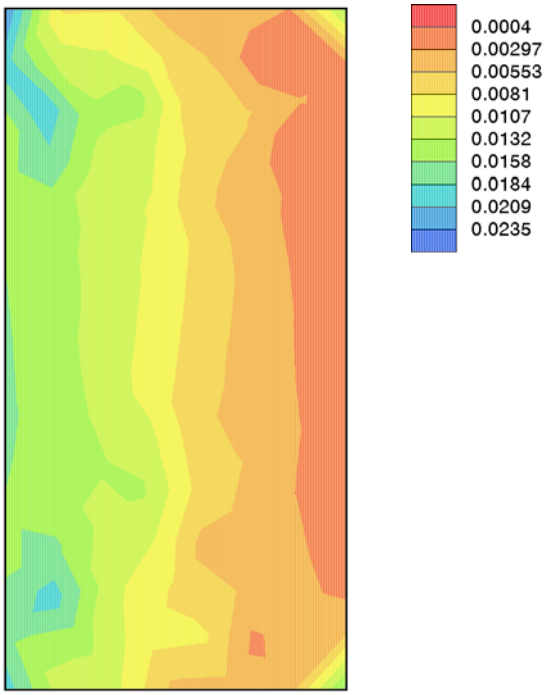
Torsionsschubspannungen τ_{tor} [N/mm²]

min τ_{tor} = 0.00 N/mm², max τ_{tor} = 0.05 N/mm²



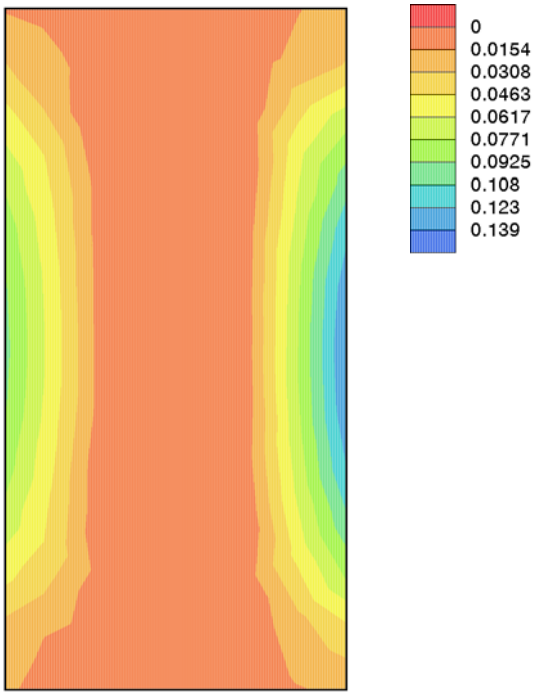
Ausnutzung $U_{\sigma xx}$

min $U_{\sigma xx}$ = 0.000, max $U_{\sigma xx}$ = 0.023



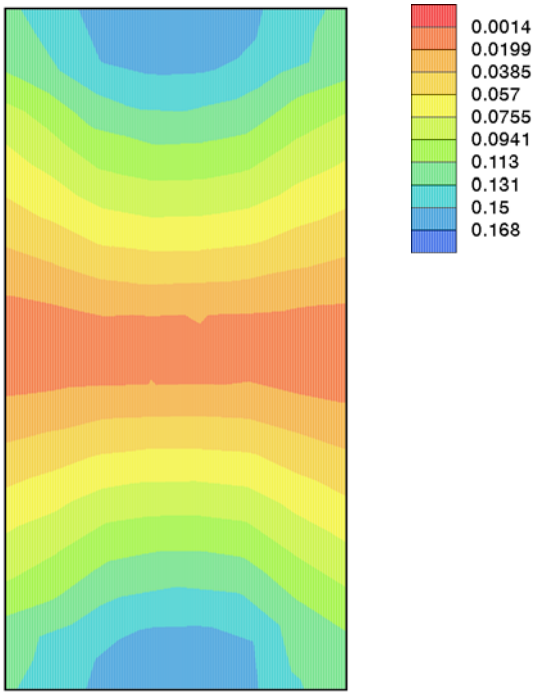
Ausnutzung $U_{\sigma yy}$

min $U_{\sigma yy}$ = 0.000, max $U_{\sigma yy}$ = 0.139

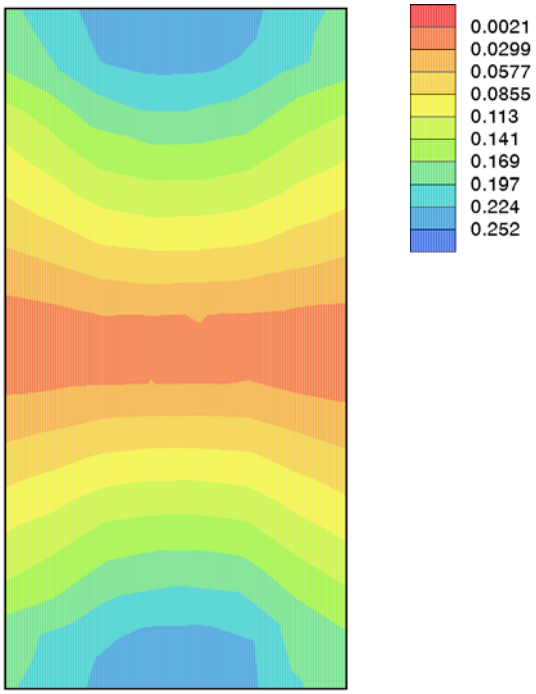


Ausnutzung $U_{\sigma yy}$

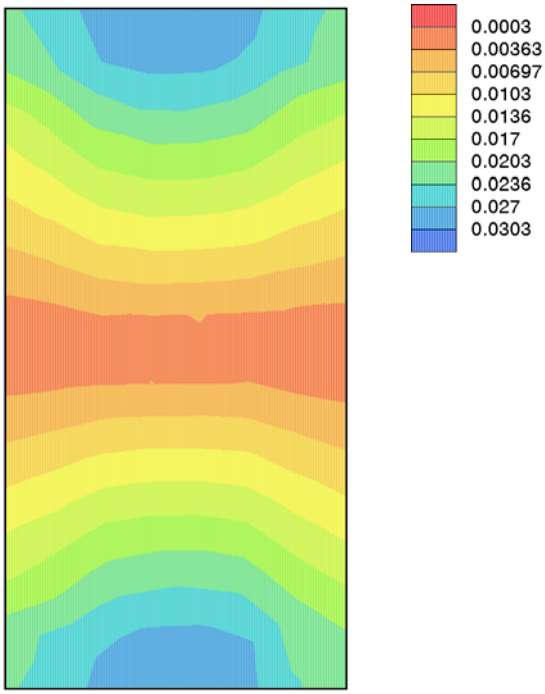
min $U_{\sigma yy}$ = 0.000, max $U_{\sigma yy}$ = 0.139



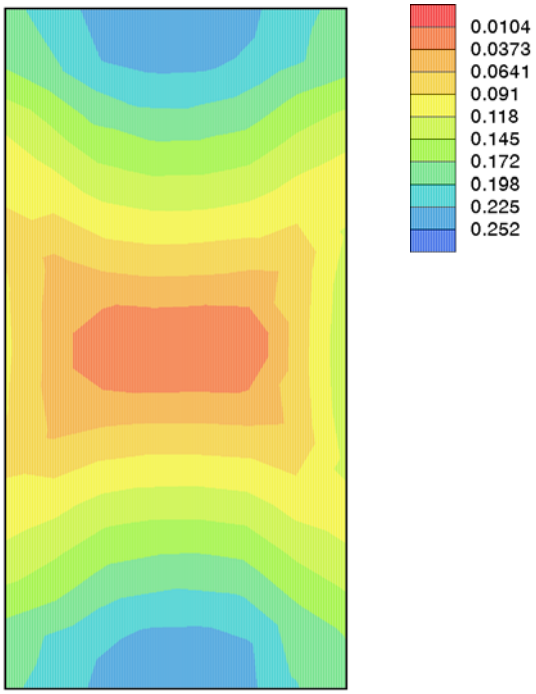
Ausnutzung $U_{\sigma yy}$
min $U_{\sigma yy}$ = 0.000, max $U_{\sigma yy}$ = 0.139



Ausnutzung $U_{\sigma yy}$
min $U_{\sigma yy}$ = 0.000, max $U_{\sigma yy}$ = 0.139



Gesamtausnutzung U
min U = 0.010, max U = 0.252



6. Detailnachweispunkte

POSITION 1, KNOTEN 92 BEI X = 0.22 M, Y = 0.15 M

Querschnittsbeschreibung

Mestek (benutzerdefiniert), Aufbau **20.0**-20.0-**20.0**-20.0-**20.0** Nadelvollholz, C24 (S10)
d_x = 60.0 mm, d_y = 40.0 mm, b = 200 mm (Brettbr.), e = 200 mm (Achsabst.), I_p = 266666667 mm^4
$f_{c0,k}$ = 21.00 N/mm^2, $f_{t0,k}$ = 14.50 N/mm^2, $f_{v,k}$ = 2.00 N/mm^2, $f_{tor,k}$ = 2.50 N/mm^2

Lastfallergebnisse

Nr	u_x mm	u_y mm	v_z ‰	n_{xx} kN/m	n_{yy} kN/m	n_{xy} kN/m	Bezeichnung
Einwirkung 1: Windlasten							
1	1.40	0.00	0.00	-3.84	0.19	-0.54	Windlast (1)

Nachweis 1: EC 5 Tragfähigkeit (Th.I.Ord.)

Ergebnisse der Lastkombinationen

Typ	u_x mm	u_y mm	v_z ‰	n_{xx} kN/m	n_{yy} kN/m	n_{xy} kN/m	Faktorisierung
Extremierung 1: Fall 1 (kmod=1.00)							
min u_x	0.00	0.00	0.00	-0.00	0.00	-0.00	
max u_x	2.10	0.00	0.00	-5.77	0.29	-0.81	1.5*Lf1
min u_y	0.00	0.00	0.00	-0.00	0.00	-0.00	
max u_y	2.10	0.00	0.00	-5.77	0.29	-0.81	1.5*Lf1
min v_z	0.00	0.00	0.00	-0.00	0.00	-0.00	
max v_z	2.10	0.00	0.00	-5.77	0.29	-0.81	1.5*Lf1
min n_{xx}	2.10	0.00	0.00	-5.77	0.29	-0.81	1.5*Lf1
max n_{xx}	0.00	0.00	0.00	-0.00	0.00	-0.00	
min n_{yy}	0.00	0.00	0.00	-0.00	0.00	-0.00	
max n_{yy}	2.10	0.00	0.00	-5.77	0.29	-0.81	1.5*Lf1
min n_{xy}	2.10	0.00	0.00	-5.77	0.29	-0.81	1.5*Lf1
max n_{xy}	0.00	0.00	0.00	-0.00	0.00	-0.00	

Nachweis der Lastkombinationen

Extremierung 1/1: min n_{xx}
Schnittgrößen: nxx = -5.77 N/mm, nyy = 0.29 N/mm, nxy = -0.81 N/mm, k_{mod} = 0.90
σ_{xx} = -0.096 N/mm², σ_{yy} = 0.007 N/mm², γ = 1.30, $f_{c0,d}$ = 14.538 N/mm², $f_{t0,d}$ = 10.038 N/mm²
$U_{\sigma x}$ = 0.007, $U_{\sigma y}$ = 0.001 ⇒ **U_σ = 0.007**
τ_{xy} = 0.013 N/mm², τ_{yx} = 0.020 N/mm², $f_{v,d}$ = 1.385 N/mm²
$U_{\tau xy}$ = 0.010, $U_{\tau yx}$ = 0.015 ⇒ **U_τ = 0.015**
n_{xy} = -0.809 N/mm², M_φ = 32340.327 Nmm, τ_{tor} = 0.003 N/mm², $f_{tor,d}$ = 1.731 N/mm², **U_{tor} = 0.002**
⇒ **U = 0.015**

Extremierung 1/1: max n_{xx}
Schnittgrößen: nxx = -0.00 N/mm, nyy = 0.00 N/mm, nxy = -0.00 N/mm, k_{mod} = 0.90
σ_{xx} = 0.000 N/mm², σ_{yy} = 0.000 N/mm², γ = 1.30, $f_{c0,d}$ = 14.538 N/mm², $f_{t0,d}$ = 10.038 N/mm²
$U_{\sigma x}$ = 0.000, $U_{\sigma y}$ = 0.000 ⇒ **U_σ = 0.000**
τ_{xy} = 0.000 N/mm², τ_{yx} = 0.000 N/mm², $f_{v,d}$ = 1.385 N/mm²
$U_{\tau xy}$ = 0.000, $U_{\tau yx}$ = 0.000 ⇒ **U_τ = 0.000**
n_{xy} = 0.000 N/mm², M_φ = 0.000 Nmm, τ_{tor} = 0.000 N/mm², $f_{tor,d}$ = 1.731 N/mm², **U_{tor} = 0.000**
⇒ **U = 0.000**

Extremierung 1/1: min n_{yy}
Schnittgrößen: nxx = -0.00 N/mm, nyy = 0.00 N/mm, nxy = -0.00 N/mm, k_{mod} = 0.90
σ_{xx} = 0.000 N/mm², σ_{yy} = 0.000 N/mm², γ = 1.30, $f_{c0,d}$ = 14.538 N/mm², $f_{t0,d}$ = 10.038 N/mm²
$U_{\sigma x}$ = 0.000, $U_{\sigma y}$ = 0.000 ⇒ **U_σ = 0.000**
τ_{xy} = 0.000 N/mm², τ_{yx} = 0.000 N/mm², $f_{v,d}$ = 1.385 N/mm²
$U_{\tau xy}$ = 0.000, $U_{\tau yx}$ = 0.000 ⇒ **U_τ = 0.000**
n_{xy} = 0.000 N/mm², M_φ = 0.000 Nmm, τ_{tor} = 0.000 N/mm², $f_{tor,d}$ = 1.731 N/mm², **U_{tor} = 0.000**
⇒ **U = 0.000**

Extremierung 1/1: max n_{yy}
Schnittgrößen: nxx = -5.77 N/mm, nyy = 0.29 N/mm, nxy = -0.81 N/mm, k_{mod} = 0.90
σ_{xx} = -0.096 N/mm², σ_{yy} = 0.007 N/mm², γ = 1.30, $f_{c0,d}$ = 14.538 N/mm², $f_{t0,d}$ = 10.038 N/mm²
$U_{\sigma x}$ = 0.007, $U_{\sigma y}$ = 0.001 ⇒ **U_σ = 0.007**
τ_{xy} = 0.013 N/mm², τ_{yx} = 0.020 N/mm², $f_{v,d}$ = 1.385 N/mm²
$U_{\tau xy}$ = 0.010, $U_{\tau yx}$ = 0.015 ⇒ **U_τ = 0.015**
n_{xy} = -0.809 N/mm², M_φ = 32340.327 Nmm, τ_{tor} = 0.003 N/mm², $f_{tor,d}$ = 1.731 N/mm², **U_{tor} = 0.002**
⇒ **U = 0.015**

Extremierung 1/1: min n_{xy}
Schnittgrößen: nxx = -5.77 N/mm, nyy = 0.29 N/mm, nxy = -0.81 N/mm, k_{mod} = 0.90
σ_{xx} = -0.096 N/mm², σ_{yy} = 0.007 N/mm², γ = 1.30, $f_{c0,d}$ = 14.538 N/mm², $f_{t0,d}$ = 10.038 N/mm²
$U_{\sigma x}$ = 0.007, $U_{\sigma y}$ = 0.001 ⇒ **U_σ = 0.007**
τ_{xy} = 0.013 N/mm², τ_{yx} = 0.020 N/mm², $f_{v,d}$ = 1.385 N/mm²
$U_{\tau xy}$ = 0.010, $U_{\tau yx}$ = 0.015 ⇒ **U_τ = 0.015**
n_{xy} = -0.809 N/mm², M_φ = 32340.327 Nmm, τ_{tor} = 0.003 N/mm², $f_{tor,d}$ = 1.731 N/mm², **U_{tor} = 0.002**
⇒ **U = 0.015**

Extremierung 1/1: max n_{xy}
Schnittgrößen: nxx = -0.00 N/mm, nyy = 0.00 N/mm, nxy = -0.00 N/mm, k_{mod} = 0.90
σ_{xx} = 0.000 N/mm², σ_{yy} = 0.000 N/mm², γ = 1.30, $f_{c0,d}$ = 14.538 N/mm², $f_{t0,d}$ = 10.038 N/mm²
$U_{\sigma x}$ = 0.000, $U_{\sigma y}$ = 0.000 ⇒ **U_σ = 0.000**
τ_{xy} = 0.000 N/mm², τ_{yx} = 0.000 N/mm², $f_{v,d}$ = 1.385 N/mm²

Nachweis der Lastkombinationen

$U_{\tau xy}$ = 0.000, $U_{\tau yx}$ = 0.000 ⇒ **U_{τ} = 0.000**
n_{xy} = 0.000 N/mm², M_{φ} = 0.000 Nmm, τ_{tor} = 0.000 N/mm², $f_{tor,d}$ = 1.731 N/mm², **U_{tor} = 0.000**
⇒ **U = 0.000**

Zusammenfassung:

$\sigma_{xx,min}$	= -0.10 N/mm²	Ex1/1:1.5*Lf1
$\sigma_{yy,min}$	= +0.00 N/mm²	Ex1/1:
$\sigma_{xx,max}$	= +0.00 N/mm²	Ex1/1:
$\sigma_{yy,max}$	= +0.01 N/mm²	Ex1/1:1.5*Lf1
τ_{xy}	= 0.01 N/mm²	Ex1/1:1.5*Lf1
τ_{yx}	= 0.02 N/mm²	Ex1/1:1.5*Lf1
τ_{tor}	= 0.00 N/mm²	Ex1/1:1.5*Lf1
$U_{\sigma,xx}$	= 0.01 N/mm²	Ex1/1:1.5*Lf1
$U_{\sigma,yy}$	= 0.01 N/mm²	Ex1/1:1.5*Lf1
U_{τ}	= 0.00 N/mm²	Ex1/1:1.5*Lf1
$U_{\tau,tor}$	= 0.01 N/mm²	Ex1/1:1.5*Lf1

Max. Ausnutzung: U = 0.015 ≤ 1 ⇒ **Nachweis erfüllt**

Zusammenfassung aller Nachweise

Lastkombination Ausnutzung: Nw1:Ex1/1[min n_{xx}]:1.5*Lf1
Max. Ausnutzung: U = 0.015 ≤ 1 ⇒ **Nachweis erfüllt**

7. Zusammenfassung

Gesamtausnutzung aller Nachweise $u_{max,Ges}$ = 0.252 ≤ 1 ⇒ ok.